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Indian Standard

SPECIFICATION FOR SHORT LINK CHAIN GRADE S(6) CALIBRATED FOR PULLEY BLOCKS AND OTHER LIFTING APPLIANCES

(First Revision)

UDC 621·86·055 : 672·63

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Indian Standard

SPECIFICATION FOR SHORT LINK CHAIN GRADE S(6) CALIBRATED FOR PULLEY BLOCKS AND OTHER LIFTING APPLIANCES

(First Revision)

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Indian Standard

SPECIFICATION FOR SHORT LINK CHAIN GRADE S(6) CALIBRATED FOR PULLY BLOCKS AND OTHER LIFTING APPLIANCES

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 30 September 1983, after the draft finalized by the Lifting Chains and Associated Fittings and Components Sectional Committee had been approved by the Marine, Cargo Movement and Packaging Division Council.

0.2 This standard was first published in 1971. The revision of this standard has been taken up to rationalize the nominal sizes of the chains to bring them in line with international practice. Further, under mechanical properties, minimum energy absorption factor has been deleted and in place of guaranteed minimum elongation at fracture, minimum total ultimate elongation has been specified.

0.3 Chains to this standard are designed for use as load chains in pulley blocks and for other applications demanding accuratelv calibrated chains of great strength and wear resisting properties. These chains are not recommended for general lifting purposes, such as, slinging.

0.4 Repairs to chains should be performed, where possible, by the original chain makers. Where this is not possible, they should be performed by a qualified chain maker or chain tester according to the instructions of the makers.

0.5 This chain demands considerable technical and manufacturing resources. Servicing the chain demands similar resources. Users are, therefore, warned to regard each length of chain as a unit which should not be modified in any way. For this reason, individual links are not marked; the chain as a unit is identified by a tag or ring welded or brazed to one end. The chain, therefore, should be sent for repair or servicing as a unit, and it is recommended that spare units are kept available.

0.6 Grade S (6) chain requires periodic inspection usual with chains. It does not need periodic heat treatment. Indeed heat treatment different from that given during manufacture can cause serious damage,

0.7 A possible range of chain blocks with working loads in R5 preferred number series with appropriate Grade S (6) load chain is given in Appendix A for information.

0.8 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard prescribes the requirements for Grade S (6) accurately calibrated lifting chains, for use as load chains in pulley blocks and other lifting appliances. These are electrically welded round steel short link chains, fully heat-treated and tested and comply with the general conditions of acceptance of IS : 5616-1982†.

The sizes from 5 to 36 mm are covered in this standard.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS : 5616-1982† shall apply.

3. DIMENSIONS

3.1 Material Diameter (*d*) — The material diameter, defined and measured in accordance with the requirements of IS : 5616-1982†, shall be as given in Table 1.

3.1.1 *Tolerance on Material Diameter* — For sizes up to and including 16 mm, the diameter *d* of the material in the finished link shall nowhere differ from the nominal diameter by more than $^{+\text{[illegible]}}_{-6}$ percent, except at the weld.

For sizes 18 mm and over, the diameter *d* of the material in the finished link shall nowhere differ from the nominal diameter by more than ±5 percent, except at the weld.

3.1.2 *Tolerances at the Weld* — The dimensions of the steel at the weld shall nowhere be less than the diameter *d* of the steel adjacent to the weld, or exceed it by more than the following tolerances (*see* Fig. 1):

a) Type 1 — 8 percent of the nominal diameter in any direction; and
b) Type 3 — 8 percent of the nominal diameter in the direction perpendicular to the plane of the link and 17 percent in other planes.

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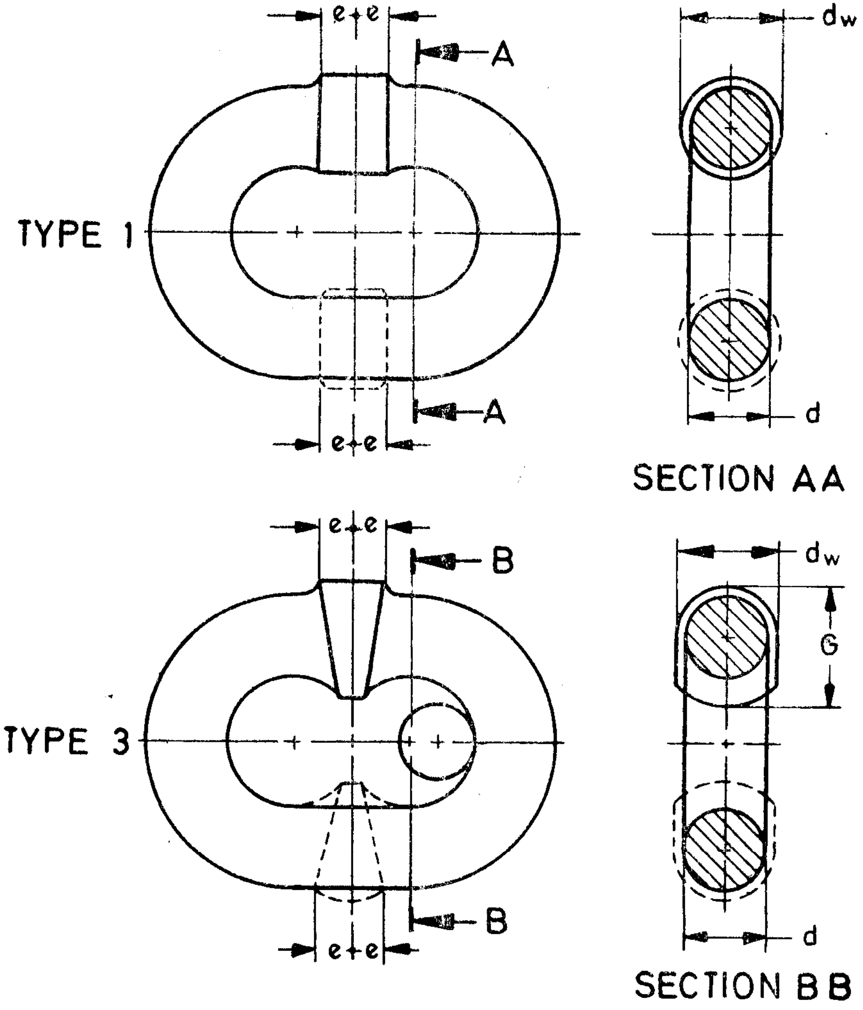
*Rules for rounding off numerical values (*revised*).

†Short link chain for lifting purposes: General conditions of acceptance (*first revision*).



d_n = Size (nominal diameter of the material),
d = Measured diameter of the material except at the weld,
d_w = Measured diameter of the material at the weld (Type 1 welded chain) or weld dimension perpendicular to the plane of the link (Type 3 welded chain),
G = Dimension in other planes (Type 3 welded chain), and
e = Length affected by welding on either side of the centre of the link.

For all welds

$e \leqslant 0{\cdot}6 d_n$

For $d_n < 16$ mm, $d = d_n \, {}^{+2}_{-6}\%$

For $d_n > 16$ mm, $d = d_n \pm 5\%$

Weld tolerances:

Type 1 : $d_w = d \, {}^{+0{\cdot}08\,d}_{0}$

Type 3 : $d_w = d \, {}^{+0{\cdot}08\,d_n}_{0}$

$G = d \, {}^{+0{\cdot}17\,d_n}_{0}$

FIG. 1 MATERIAL AND WELD TOLERANCES

TABLE 1 DIMENSIONS OF GRADE S (6) CALIBRATED CHAIN

(*Clause* 3.1)

All dimensions in millimetres.

Nominal Size d_n	Diameter Tolerance ($d-d_n$)	Maximum Tolerance at Weld (*see* Fig. 1)		Preferred Pitch (Inside Length) $3\ d_n$	Pitch Tolerance (One Link only)	Preferred Outside Width $3{\cdot}25\ d_n$	Outside Width Tolerance	
		Types 1 and 3 (d_w-d)	Type 3 ($G-d$)				Away from Weld Zone $+0{\cdot}075\ d_n$	Weld at Zone $+0{\cdot}17\ d_n$
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
5	+0·10, −0·30	0·40	0·85	15	0·29	17	0·38	0·85
6	+0·12, −0·36	0·48	1·00	18	0·35	20	0·45	1·0
*7·1	+0·14, −0·43	0·57	1·2	21	0·41	23	0·54	1·2
8	+0·16, −0·48	0·64	1·35	24	0·46	26	0·60	1·4
*9	+0·18, −0·54	0·72	1·55	27	0·52	30	0·68	1·6
10	+0·20, −0·60	0·80	1·7	30	0·58	33	0·75	1·7
11	+0·22, −0·66	0·88	1·85	33	0·64	36	0·83	1·9
12	+0·24, −0·72	0·96	2·05	36	0·69	39	0·90	2·0
14	+0·28, −0·84	1·12	2·4	42	0·81	46	1·05	2·4
16	+0·32, −0·96	1·28	2·7	48	0·93	52	1·2	2·7
18	±0·90	1·44	3·05	54	1·04	59	1·35	3·1
20	±1·0	1·6	3·4	60	1·16	65	1·5	3·4
22	±1·1	1·76	3·7	66	1·26	72	1·65	3·7
25	±1·25	2·0	4·25	75	1·45	81	1·88	4·3
28	±1·4	2·24	4·75	84	1·62	92	2·1	4·8
32	±1·6	2·56	5·45	96	1·85	104	2·4	5·4
36	±1·8	2·88	6·1	108	2·15	116	2·7	6·1

*These sizes will be supplied subject to agreement between the manufacturer and the purchaser.

3.1.3 *Area Affected Dimensionally by Welding* — The weld or welds are positioned in the centre of one or both legs of the link. The area affected dimensionally by welding shall not extend by more than 0·6 times the material diameter to either side of the centre of the link.

3.2 Length and Width (*see* Fig. 2)

3.2.1 *Nominal Dimensions* — Preferred nominal dimensions are:

a) Pitch, p (that is, inside length) : 3 times the nominal chain size (d_n)

b) Outside width, w : 3·25 times the nominal chain size (d_n).

Where the chain has to fit a load wheel designed for different dimensions, the nominal pitch and the nominal outside width shall be clearly specified at the time of enquiry and order.

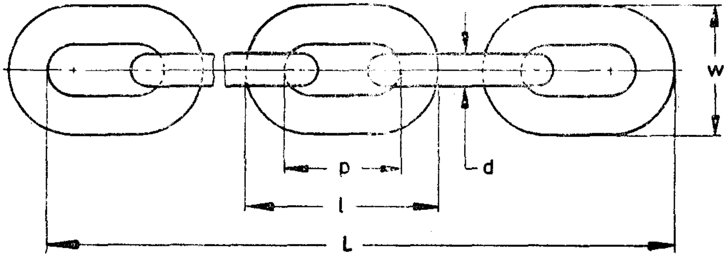


FIG. 2 CHAIN AND LINK DIMENSIONS

3.2.2 *Tolerances*

a) *Outside width* w (*measured on the chain in the finished condition*) — The outside width w measured clear of the weld zone, shall not vary from the nominal outside width by more than $^{+0{\cdot}075}_{-0}\,d_n$.

At the weld zone, the outside width shall not be more than 1·05 times the adjacent width.

b) *Length* (*measured on the chain in the finished condition*) — The inside length of one link (pitch p) or the sum L of the inside lengths of any number of links N, measured bearing to bearing under a force not greater than half the specified proof force of the chain, shall not vary from the nominal length (N_p) by more than following percentage tolerance:

$$\frac{\Delta L \times 100}{N_p} = {}^{+\left(\frac{1{\cdot}6}{N} + 0{\cdot}33\right)}_{-\;0}\ \text{percent}$$

Examples:

Nominal Size dn, mm	*Number of Links in Chain, N*	*Tolerance (plus only)*	
		Percent	mm
6	1	1·93	0·35
	5	0·65	0·58
	21	0·406	1·53
10	1	1·93	0·58
	5	0·65	0·975
	21	0·406	2·56
20	1	1·93	1·16
	5	0·65	1·95
	21	0·406	5·12

4. MATERIAL

4.1 The steel used shall be produced by the open-hearth or electric process, or by an oxygen blown process.

4.1.1 In its finished state as supplied to the chain maker, it shall meet the following requirements as determined by check analysis on the rod, wire or finished link.

4.1.2 It shall be an alloy steel of reliable welding quality capable of being heat-treated to produce the mechanical properties required.

4.1.3 It shall be fully killed and shall contain alloying elements in sufficient quantities to guarantee the mechanical properties of the chain after appropriate heat treatment. The alloy steel used shall contain at least two of the following alloying elements or their equivalents:

Nickel,
Chromium,
Molybdenum, and
Boron.

Neither manganese nor silicon shall in this context be considered as alloying elements.

4.1.4 Its content of sulphur and phosphorus shall be restricted as follows:

	Cast Analysis (percent)	*Check Analysis* (percent)
Sulphur, *Max*	0·035	0·040
Phosphorus, *Max*	0·035	0·040

4.1.5 The steel shall be made in conformity with fine grain practice to give an austenitic grain size of 5 or finer when tested in accordance with IS : 2853-1964*. This could be accomplished by ensuring that it contains sufficient aluminium, or equivalent element, to allow the manufacture of chain stabilized against strain age embrittlement during service; a minimum value of 0·020 percent metallic aluminium is recommended for guidance.

4.2 Within the above limitations it is the responsibility of the chain maker to select a steel so that the finished chain suitably heat-treated meets the specified mechanical properties.

5. HEAT TREATMENT

5.1 All chains shall be hardened by heating to a temperature within 50°C above the upper critical point of the steel used, followed by quenching in oil, brine or water at a suitable temperature and tempered, before being subjected to the proof force.

6. PROOF FORCE

6.1 After manufacture, heat treatment and other processing, the finished chain shall be subjected to the proof force given in Table 2 and shall be applied as specified in IS : 5616-1982†.

6.2 After calibrated chain has been subjected to proof force, the pitch of the chain, adjusted where necessary, shall be verified by trying the chain in an appropriate mould or by running it over an actual sheave. It is required for conforming to the requirements of this clause, that the link shall fall smoothly into the pockets of the mould or sheave with a working fit. The links shall not be shortened to adjust the pitch.

7. TEST REQUIREMENTS

7.1 General — The actual test forces to be applied for each size are given in Table 2. The mechanical properties required of this grade of chain are summarized in Table 3.

7.2 Selection of Samples — Samples shall be selected as specified in IS : 5616-1982†. The length of the lot from which a sample is selected by the inspector is 200 m or part thereof.

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*Method of determining austenitic grain size of steel.

†Short link chain for lifting purposes: General conditions of acceptance (*first revision*).

TABLE 2 GRADE S (6) TEST REQUIREMENTS AND LIFTING CAPACITIES

(*Clauses* 6.1, 7.1 *and* 7.3.1)

NOMINAL SIZE *d*n (1) mm	PROOF FORCE (ACCEPTANCE) (2) kN	MINIMUM BREAKING FORCE (3) kN	WORKING LOAD LIMIT (4) tonne
5	12·4	24·8	0·63
6	17·9	35·8	0·9
7·1	25	50	1·25
8	31·7	63·4	1·6
9	40·1	80·2	2·0
10	49·5	99	2·5
11	60	120	3·0
12	72	144	3·6
14	99	198	5·0
16	127	254	6·3
18	161	322	8·0
20	198	396	10
22	244·5	489	12·5
25	314	628	16
28	393	786	20
32	507	1 014	25
36	642	1 284	32

7.3 Static Tensile Test

7.3.1 The breaking force determined in accordance with IS : 5616-1982* shall not be less than that specified in Table 2.

7.3.2 *Total Ultimate Elongation* — The total ultimate elongation as defined in IS : 5616-1982* shall not be less than 13 percent.

8. INSPECTION

8.1 Acceptance Procedure — The acceptance procedure specified in IS : 5616-1982* shall be followed to determine the acceptability or otherwise of the chain.

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*Short link chain for lifting purposes: General conditions of acceptance (*first revision*).

TABLE 3 MECHANICAL PROPERTIES

(*Clause* 7.1)

MECHANICAL PROPERTY	REQUIREMENT
Mean stress at specified minimum breaking force $\dfrac{2F_m\ min}{\pi d_n^2}$	630 MPa (N/mm^2)
Mean stress at proof force $\dfrac{2F_e}{\pi d_n^2}$	315 MPa (N/mm^2)
Ratio of proof force to specified minimum breaking force	50 percent
Specified minimum total ultimate elongation	13 percent
Mean stress at working load limit	157·5 MPa (N/mm^2)

NOTE—The stresses given in this table are obtained by dividing the force by the total cross section of both sides of the link, that is, they are mean stresses. The stress is in fact not uniform, and particularly at the extrados the maximum fibre stress is considerably greater.

9. MARKING

9.1 Quality Marking — The chain shall be marked with 'S' or '6' in a circle that is Ⓢ or ⑥ as recommended in IS : 5616-1982*.

9.2 Identification Marking — The identification marking shall comply with the requirements of IS : 5616-1982*.

9.3 Inspection Marking — Inspection marking shall comply with the requirements of IS : 5616-1982*.

10. TEST CERTIFICATE

10.1 The manufacturer shall supply a certificate of test and examination with every supply of chain. A typical form is given in Appendix B of IS : 5616-1982*. The certificate shall give the following information:

a) Name of the chain maker;
b) Grade of material;
c) Size of chain;
d) Identification marking;
e) Proof force applied to the whole chain;
f) Number of test samples taken;
g) Breaking force of each sample; and
h) Total ultimate elongation.

NOTE — All testing shall be done in the presence of a competent person or in an approved testing establishment.

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*Short link chain for lifting purposes: General conditions of acceptance (*first revision*).

APPENDIX A

(*Clause* 0.7)

A POSSIBLE RANGE OF CHAIN BLOCKS WITH WORKING LOADS IN THE R 5 PREFERRED SERIES, WITH APPROPRIATE GRADE S (6) LOAD CHAINS

Lifting Capacity tonnes	*Grade 63 Load Chain Size* mm
1·0	6
1·6	8
2·5	10
4·0	12
6·3	16
10·0	20

The purpose of this Appendix is to illustrate one possible mode of application for a range of blocks. The lifting capacities have been rounded, and appropriate chains have been selected. There are many other ways in which a selection can be made.